EXPLANATION OF SIGNIFICANT DIFFERENCES FOR THE 100-NR-1 OPERABLE UNIT TREATMENT, STORAGE, AND DISPOSAL (TSD) INTERIM ACTION RECORD OF DECISION (ROD) AND 100-NR-1/100-NR-2 OPERABLE UNIT INTERIM ACTION ROD

December 2002

SITE NAME AND LOCATION

U.S. Department of Energy 100 Area
100-NR-1 and 100-NR-2 Operable Units Hanford Site
Benton County, Washington

INTRODUCTION TO THE SITE AND STATEMENT OF PURPOSE

The Washington State Department of Ecology (Ecology), U.S. Environmental Protection Agency (EPA), and the U.S. Department of Energy (DOE), hereafter referred to as the Tri-Parties, are issuing this Explanation of Significant Differences (ESD) to provide public notice on changes to two Records of Decision (RODs) issued for the 100-N Operable Unit (OU) located on the Hanford Site. The two RODs are as follows:

- *Interim Remedial Action Record of Decision for the 100-NR-1 Operable Unit of the Hanford 100-N Area*[1] (Treatment, Storage, and Disposal [TSD] ROD)
- *Interim Remedial Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units*[2] (100-NR-1/100-NR-2 ROD).

The TSD ROD addresses contaminated soils, structures, and pipelines associated with two TSD units in the 100-NR-1 OU: the 116-N-1 and 116-N-3 waste sites. The 100-NR-1/100-NR-2 ROD addresses all the other remaining soil waste sites in the 100-NR-1 OU, as well as the 100-NR-2 groundwater OU.

The TSD ROD included a remedial action objective (RAO) that residual contamination will not exceed maximum contaminant levels (MCLs) for protection of groundwater. The ROD stated that protection could be demonstrated using modeling. The Tri-Parties have previously agreed to use certain standard assumptions in the RESidual RADioactivity (RESRAD) model. One standard assumption is 76 centimeters per year (cm/yr) (30 inches per year [in./yr]) of irrigation. This ESD provides notice and justification for a change to the irrigation assumption and would remove it from consideration at the 116-N-1 waste site.

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[1] Ecology, January 2000, *Interim Remedial Action Record of Decision for the 100-NR-1 Operable Unit of the Hanford 100-N Area, Hanford Site, Benton County, Washington* (also known as the "TSD ROD"), Washington State Department of Ecology, Olympia, Washington.

[2] Ecology, December 1999, *Interim Remedial Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units of the Hanford 100-N Area, Hanford Site, Benton County, Washington* (also known as the "100-NR-1/100-NR-2 ROD"), Washington State Department of Ecology, Olympia, Washington.

The TSD ROD allows for consideration of eight "balancing factors" to determine the extent of additional excavation needed in situations where residual contamination exists below the engineered structure and at a depth greater than 4.6 meters (m) (15 feet [ft]), which exceeds the RAO for protection of groundwater. The "balancing factors" are a set of eight criteria specified in the TSD ROD and are provided in Table 1 of this ESD. Because this interim action will leave residual contamination greater than 4.6 m (15 ft), a "balancing factors" evaluation was performed to determine the extent of remediation. The balancing factors evaluation (Table 1) indicates that elimination of 0.76 cm/yr (30 in./yr) of irrigation water and the continuation of institutional controls (ICs) as required by the TSD ROD will protect human health and the environment.

The TSD ROD requires submittal of a report on the effectiveness and implementation of ICs for the 100-NR-1 and 100-NR-2 OUs to Ecology by July 31 for the preceding calendar year. A second change to the TSD ROD is to remove the July 31 annual IC reporting requirement. The DOE will comply with the TSD ROD requirement to submit an annual IC report by including the reporting requirements in an annual sitewide IC report. This sitewide report is required by the *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions*[3]. This change is consistent with EPA's 5-year ROD review conducted in 2001.

The 100-NR-1/100-NR-2 ROD also requires submittal of a report on the effectiveness and implementation of ICs for the 100-NR-1 and 100-NR-2 OUs to Ecology by July 31 for the preceding calendar year. Additionally, the change to the 100-NR-1/100-NR-2 ROD is to remove the July 31 annual IC report requirement. The DOE will comply with the 100-NR-1/100-NR-2 ROD requirement to submit an annual IC report by including the reporting requirements in an annual sitewide IC report as required by the *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions.*

The Tri-Parties are issuing this ESD in accordance with Section 117(c) of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) and Section 300.435(c)(2)(i) and Section 300.825(a)(2) of the "National Oil and Hazardous Substances Pollution Contingency Plan" (NCP). The ESD allows for changes to an approved remedy that do not fundamentally alter the overall cleanup approach. Its purpose is to provide public notice on the significant changes identified above and the information that led to making the changes. Following a 30-day public comment period, the Tri-Parties will consider public comment before modifying and approving the ESD. The approved ESD will become part of the Administrative Record for the cleanup decision for the 100-N Area of the Hanford Site. The Administrative Record is available for review at the following location:

Administrative Record
2440 Stevens Center Place, Room 1101
Richland, Washington 99352
509/376-2530
Attention: Debbi Isom

[3] DOE-RL, 2002, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions*, DOE/RL-2001-41, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Application of the Criteria for Balancing Factors to Determine Extent of Remediation

Cleanup activities in a large section of the 116-N-1 waste site, which is contaminated with cesium-137, cobalt-60, europium-154, europium-155, plutonium-239/240, strontium-90 (Sr-90), etc., have achieved the maximum excavation depth contemplated in the TSD ROD, which was approximately 4.6 m (15 ft). Previous evaluation in the *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan*[4] (CMS/CP) indicated that removal of contaminated soil to this depth would be adequate to meet RAOs for groundwater protection. Soil sampling data were used in a three-layer computer model to evaluate compliance with RAOs. Dangerous waste constituents would not cause exceedance of the groundwater protection RAO. Borehole data for the deep zone (greater than 4.6 m [15 ft]) layer B averaged approximately 791 picocuries per gram (pCi/g) Sr-90, while concentrations in the deep zone layer C averaged approximately 78 pCi/g Sr-90.

The rural-residential exposure scenario presented in the TSD ROD assumes the application of 0.76 m/yr (30 in./yr) of irrigation water from an offsite, uncontaminated source. RESRAD modeling results showed that contamination in the two bottom layers, below the existing excavation (deep zone layers B and C; Figure 2), would exceed the groundwater protection RAO of 8 pCi/L for Sr-90 (corresponding to a drinking water MCL of 4 mrem/yr radiation dose). The modeled discharge concentration was 37.8 pCi/L of Sr-90 at the groundwater interface. The modeled Sr-90 discharge to groundwater without irrigation is approximately 6 pCi/L, which achieves the RAO and is below the 8 pCi/L drinking water standard.

The TSD ROD states:

> "Institutional controls and long-term monitoring will be required where wastes are left in place and preclude an unrestricted land use. Institutional controls selected as part of this remedy are designed to be consistent with the interim action nature of this ROD. Additional measures may be necessary to ensure long-term viability of institutional controls if the final remedial actions selected for the 100 Area does not allow for unrestricted land use. Any additional controls will be specified as part of the final remedy."

The 100-NR-1 waste sites will remain under the control of the DOE for the remaining duration of the interim remedial action. Institutional controls will be maintained in accordance with DOE's Sitewide Institutional Controls Plan. Those controls will prevent irrigation during that period. The interim action ROD states that DOE shall ensure the long-term viability of ICs as part of the final remedy.

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[4] DOE-RL, 1998, *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan*, DOE/RL-96-39, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Revision of the Annual Institutional Controls Reporting Requirement (TSD ROD and 100-NR-1/100-NR-2 ROD)

The TSD ROD and 100-NR-1/100-NR-2 ROD state that a report on the implementation and effectiveness of ICs for the 100-NR-1 and 100-NR-2 OUs shall be submitted to Ecology by July 31 for the preceding calendar year. However, the *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions,* approved by the Tri-Parties in July 2002, establishes an annual sitewide IC report beginning in July 2003.

This ESD revises the reporting requirements for the TSD ROD and the 100-NR-1/100-NR-2 ROD to eliminate the July 31 requirement and allows DOE to fulfill the annual IC reporting requirements for the 100-NR-1 and 100-NR-2 OUs as part of the required annual reporting on sitewide ICs.

SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

The 116-N-1 waste site received radioactive liquid waste containing activation and fission products as well as small quantities of corrosive liquids and laboratory chemicals generated by various N Reactor operations. The 116-N-1 waste site, which was in operation from 1963 to 1985, is 88 m (290 ft) long by 38 m (125 ft) wide by 1.5 m (5 ft) deep. The contaminants of concern in the surface soils were derived from data in the *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan.* The radionuclides of concern include cesium-137, cobalt-60, europium-154, europium-155, plutonium-239/240, Sr-90, and tritium. The 116-N-1 waste site is actively undergoing remediation, which began October 2001. Contaminated soil in the top 4.6 m (15 ft) is being removed and disposed as required by the TSD ROD. This represents a significant mass of the contamination.

The selected remedies established in both the existing TSD ROD and 100-NR-1/100-NR-2 ROD remain unchanged. This ESD removes the July 31 annual IC reporting requirement in both RODs and requires the submittal of an annual sitewide report as required by the *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions.* Additionally, this ESD eliminates the application of 76 cm (30 in.) of irrigation water in the rural-residential exposure scenario (TSD ROD) for the 116-N-1 waste site.

The land use for the 116-N-1 waste site remains consistent with the *Final Hanford Comprehensive Land Use Plan Environmental Impact Statement* (CLUP) (DOE/EIS-0222F) and the Hanford Reach National Monument. President William Jefferson Clinton, to reserve the Hanford Reach for the purpose of protecting the ecological, cultural, natural resources and lands, established the Hanford Reach National Monument. This action occurred after the issuance of the TSD ROD.

The purpose of the CLUP is to facilitate the decision-making process regarding the Hanford Site's uses and facilities over at least the next 50 years. Additionally, the overall goal of the CLUP is to balance the needs at the Hanford Site with the desire to preserve important ecological and cultural values of the site allowing for economic development. The CLUP ROD identifies the 100-NR-1 OU within the geographic area of the Columbia River Corridor. The remediation and restoration efforts in the Columbia River Corridor are expected to return the lands to undeveloped, natural conditions over the next 75 years. Restrictions on certain activities may continue to be required to prevent the mobilization of contaminants, the most likely example of which is the restriction of activities that discharge water to the soil or involve excavating below 4.6 m (15 ft). The CLUP identifies the remediation activities in the 100-N Area pre-existing, nonconforming land use in the Preservation land-use designation. The Preservation land-use designation requires the management of the land for the preservation of archeological, cultural, ecological, and natural resources, while prohibiting new consumptive uses (mining) and limiting public access.

BASIS FOR THE DOCUMENT

The 100-NR-2 groundwater OU, which is contaminated with Sr-90, runs beneath the 116-N-1 Crib. A pump-and-treat system has been operating for 5 years, which reduces the net flow of groundwater through the aquifer, thereby reducing the Sr-90 contamination entering the Columbia River. The pump-and-treat system removes approximately 90% of the Sr-90 from the groundwater and is expected to continue as required by the 100-NR-1/100-NR-2 ROD.

The Sr-90 concentrations in the 100-N Area aquifer underlying the 100-NR-1 waste sites reached as high as 14,700 pCi/L, with 2,000 pCi/L reported as the current level (*Hanford Site Environmental Report 2000* [PNNL-13487]). RESRAD modeling of the deep zone indicates that the lowest soil column layer beneath the 116-N-1 waste site contributes Sr-90 to the groundwater at levels that exceed the RAO for protection of the groundwater (37.8 pCi/L predicted value). The one parameter causing the modeled result to exceed the Sr-90 RAO of 8 pCi/L is the 76 cm (30 in.) of irrigation per year from the rural-residential exposure scenario identified in the TSD ROD. While the mass of the Sr-90 that may reach the groundwater from the 116-N-1 waste site is inconsequential as compared to the Sr-90 burden already present in the groundwater, modeling shows that by eliminating irrigation, the RAO of 8 pCi/L would be attained.

Figure 1 shows the 116-N-1 waste site located in the 100-NR-1 OU, and Figure 2 is a conceptual drawing showing the subsurface beneath 116-N-1.

The TSD ROD identifies eight balancing factors to be considered when residual contamination is present below the engineered structure at a depth greater than 4.6 m (15 ft). Four remedial technologies and methods were screened for further evaluation through the balancing factor analysis: excavation to groundwater by conventional methods, excavation to groundwater by soil augering, excavation using remotely operated excavators, a subsurface barrier, and the use of ICs to prevent irrigation. These methods were chosen in order to provide a basis for comparing the balancing factor data and completing the evaluation. A cost summary of each of the four methods that were screened during the second portion of the balancing factors analysis is presented in Appendix A.

The use of remotely operated excavators was not given further consideration due to numerous factors. One factor is the lack of information in the various cost-estimating databases (e.g., RS Means and U.S. Army Corp of Engineers databases) needed to support this ESD. Without this information, unit production rates cannot be calculated. Remotely operated excavators have been used at the Idaho National Engineering and Environmental Laboratory (INEEL) and at the 100-F Area of the Hanford Site. INEEL staff stated that, as a general rule of thumb, using remotely operated excavators costs four times the cost of conventional methods. Based on field experience at the 100-F Area, the remote excavation equipment experienced frequent breakdowns and was difficult to keep operational for extended periods of time. Field staff also indicated severe limitations when using remote excavators at a large-scale soil excavation such as at the 116-N-1 waste site. The remote equipment in use at the 100-F Area provides an excavator bucket capacity of 0.25 cubic yards, while conventional equipment routinely has a capacity of approximately 3.5 cubic yards; production rates would be substantially lower with remotely operated equipment as well. Therefore, in view of the factors above, remotely operated equipment was not considered further for the purposes of this ESD.

Excavation to groundwater using conventional methods uses heavy equipment to excavate contaminated soil that is loaded into containers and disposed of at the Environmental Restoration Disposal Facility (ERDF). Excavation to groundwater using soil augering uses equipment commonly used in soil and bridge foundation emplacement. A large-diameter (up to 2 m) auger penetrates the earth to the desired depth while a steel casing is also advanced. The auger rotates, displacing the soil to the surface where it empties out of the top of the steel casing and is containerized and sent to ERDF. A cementaceous grout is pumped into the casing, the casing is removed, and the rig is moved to an adjacent starting point. This process is repeated until the bulk of the desired area has been augered.

A subsurface barrier is a series of layers that prevent potential irrigation water from contacting the contaminated soil below the barrier. The subsurface barrier model for this ESD includes a small grading fill layer at the excavation bottom to create a slight dome, a 0.6-m (2-ft)-thick clay layer, a high-density polyethylene (HDPE) liner, and clean backfill to be placed in the bottom of an excavated trench. The barrier design includes the excavation of additional soil at the bottom and projecting an additional 6 m (20 ft) from the side of the waste site. The subsurface barrier has not been modeled at the Hanford Site. Cost estimates include simulation modeling of the effectiveness of the subsurface barrier. Subsurface probes and geophysical methods could monitor actual barrier performance. The subsurface barrier includes a HDPE liner. HDPE liners have not been in use long enough to field test their durability and long-term performance.

Institutional controls consist of physical measures and administrative and legal controls, as identified in the RODs, to prevent unauthorized access or use of a specific site or location. An annual report is required to document effectiveness of the ICs, including any recommendations.

The balancing factors analysis table (Table 1) determined that both methods of excavation to groundwater (1) had significant impacts to the protection of human health and the environment and worker safety, (2) had potential to impact the sizing of the ERDF by requiring nearly an entire new ERDF cell to accommodate the added waste volumes, and (3) significantly increase the cost of remediation and duration. Impacts to human health and the environment include the following: workers would be exposed to significant radiation doses, and additional backfill would require establishing new borrow pits, resulting in excavation of additional areas.

Additional excavation would also result in the partial destruction of the *Mooli –Mooli*, a series of geologic knobs and kettles caused by cataclysmic flooding that are culturally significant to the Wanapum. The statements relating the significance of *Mooli -Mooli* are attributed to the Wanapum because they have specifically expressed their views during consultations relating to the remedial action. Based on discussion with the Wanapum, the *Mooli –Mooli* is a cultural landscape that contains legends, stories, and spiritual power that remain important in continuance of their religion, traditions, and heritage. It is an area where youths, as young as 5 to 6 years of age, were sent to conduct vision quests, a practice they would follow throughout their lifetime in age-specific locations within the Hanford Site and the Columbia Basin. The mounds are a traditional place of power. The *Mooli -Mooli* also has cultural and religious significance to other Native American communities with ancestral ties to the Hanford Site, such as the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, and the Yakama Nation.

While a subsurface barrier minimizes the amount of Sr-90 leached to the groundwater, the impacts to the ecological and cultural resources are similar to those from excavation methods due to the added excavation needed to ensure the barrier fully covers the waste site (an additional 6 m [20 ft]). The 6-m (20-ft) overlap is necessary to prevent recharge under the barrier based on results of monitoring at the Hanford prototype barrier in the 200 Areas.

By removing the 76 cm (30 in.) of irrigation water from the RESRAD model for the 116-N-1 waste site, the balancing factors analysis demonstrated that the use of ICs to prevent irrigation prevented worker exposure to radiation, is protective of human health and the environment, is cost-effective, does not add additional ERDF cells, and does not negatively impact ecological or cultural resources. Based on the CLUP ROD requirement for preservation areas, it may be necessary to restrict certain activities to prevent the mobilization of contaminants, the most likely example of which is the restriction of activities that discharge water to the soil or involve excavating below 4.6 m (15 ft). The fundamental change of eliminating irrigation water is consistent with the CLUP ROD. Furthermore, maintaining ICs would preserve cultural resources as stated in the Executive Order for the Hanford Reach National Monument.

DESCRIPTION OF SIGNIFICANT DIFFERENCES

The elimination of 76 cm/yr (30 in./yr) of irrigation from the rural-residential exposure scenario and the associated addition of fencing around the 116-N-1 waste site as an IC, based on an evaluation of balancing factors, is consistent with the provisions of the TSD ROD and does not change the existing RAOs. Although the additional IC would need to be included in the sitewide IC plan, the associated costs would be insignificant compared with the cost of excavating to groundwater.

Consolidation of the TSD ROD and the 100-NR-1/100-NR-2 OU ROD annual IC information into the sitewide annual IC report and removing the July 31 annual reporting requirement in both RODs is consistent with the sitewide IC plan approved by the Tri-Parties, as well as the EPA 5-year ROD review conducted in 2001.

SUPPORT AGENCY COMMENTS

By issuance of this ESD, the Tri-Parties concur with the significant differences identified above and the balancing factors analysis.

STATUTORY DETERMINATIONS

This modified remedy satisfies CERCLA Section 121.

The interim remedy selected in the TSD ROD and the 100-NR-1/100-NR-2 ROD, as modified by this ESD, remains protective of human health and the environment; complies with Federal and state requirements that are applicable or relevant and appropriate to remedial actions; is cost-effective; and uses permanent solutions and alternative treatment technologies to the maximum extent practicable.

PUBLIC PARTICIPATION

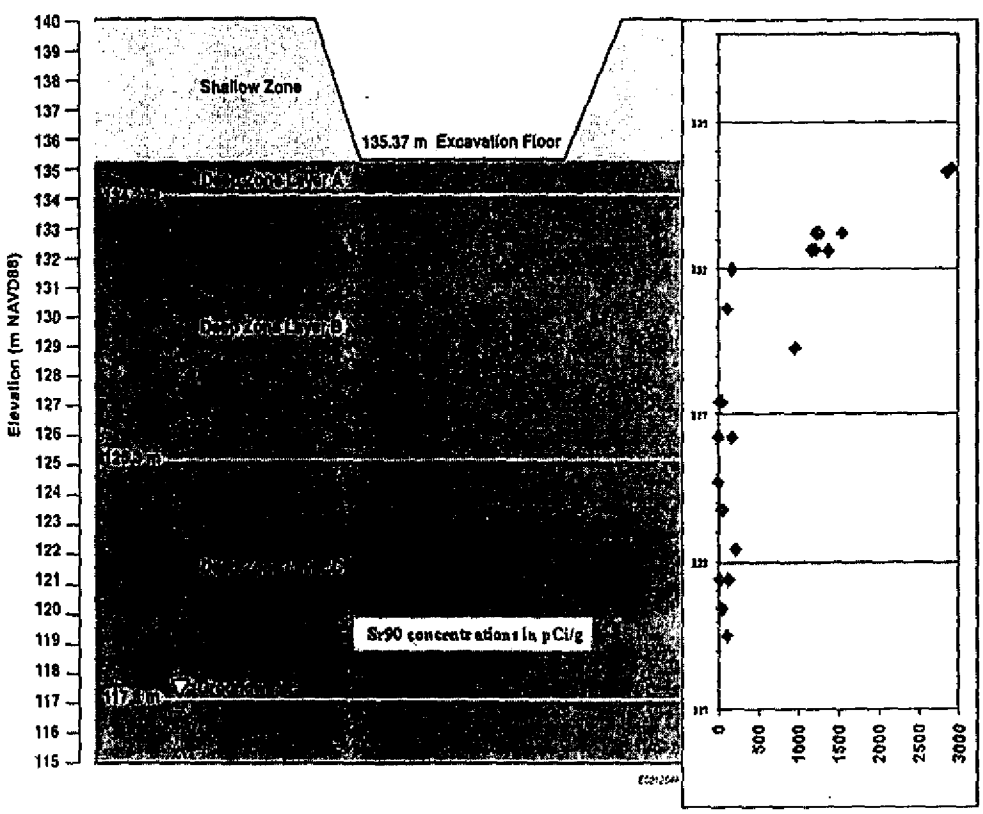
The public participation requirements set forth in Section 300.435(c)(2)(i) of the NCP are met through issuance of this ESD. In addition, a 30-day public comment period is being provided in accordance with the TSD ROD prior to making a final determination.

Table 1. Balancing Factors Analysis.

Balancing Factor Criteria	Excavation with Conventional Methods to Groundwater and No Change to Irrigation Rate (30 in./yr)	Excavation with Soil Augering to Groundwater and No Change to Irrigation Rate (30 in./yr)	Subsurface Barrier and No Change to Irrigation Rate (30 in./yr)	Eliminate 30-in./yr Irrigation Rate and Maintain Institutional Controls
1. Reduction in Risk by Decay of Short-Lived Radionuclides (half-life less than 30.2 years). Is the radionuclide short-lived?	No impact.	No impact.	Half-life of Sr-90 is 28 years. Natural decay will reduce groundwater levels of Sr-90 to below maximum contaminant levels in less than 300 years without any action.	Half-life of Sr-90 is 28 years. Natural decay will reduce groundwater levels of Sr-90 to below maximum contaminant levels in less than 300 years without any action.
2. Protection of Human Health and the Environment	Method exposes workers to significant doses of radiation. New borrow pits would be necessary and may incur environmental damage.	Method cannot remove all of the contaminated soil due to the design of the equipment. New borrow pits would be necessary and may incur environmental damage.	Method would reduce the amount of water leaching Sr-90 into the groundwater.	Eliminating irrigation lowers the amount of Sr-90 potentially leaching from the soil, and meets protection of groundwater. Does not expose workers to radiation.
3. Remediation Costs (estimated)	$54.3M (32 additional months to complete). Modification to the Hanford Resource Conservation and Recovery Act (RCRA) Permit may be necessary for the schedule and other items.	$105.1M (62 additional months to complete). Modification to the Hanford Resource Conservation and Recovery Act (RCRA) Permit may be necessary for the schedule and other items.	$5.7M (12 additional months to complete). Modification to the Hanford Resource Conservation and Recovery Act (RCRA) Permit may be necessary for the schedule and other items.	$2,000/year to implement ICs.
4. Sizing of the Environmental Restoration Disposal Facility (ERDF)	ERDF expansion necessary. Approximately 0.75 new cells would be used to accept additional waste from 116-N-1.	ERDF expansion necessary. Approximately 0.6 of new cell would be used to accept waste from 116-N-1.	ERDF expansion not necessary from the minimal additional waste from the additional 20 ft to ensure the barrier covers the waste site.	ERDF expansion not necessary.
5. Worker Safety	Extensive personal protective equipment (PPE) required (Anti-Cs and industrial safety). Radiation dose exposure 11,000 people-mrem.	Extensive PPE required (Anti-Cs and industrial safety). Radiation dose exposure estimate 500,000+ people-mrem.	Radiation dose exposure estimate <500 people-mrem.	No additional worker exposure to radiation.
6. Presence of Ecological and Cultural Resources	Soil removal would impact *Mooli-Mooli* (east end of 116-N-1). The Wanapum do not want this site impacted.	Minimal intrusion into *Mooli-Mooli*. The Wanapum do not want this site impacted.	Removal of the 20-ft perimeter to the northeast end would impact *Mooli-Mooli*. The Wanapum do not want this site impacted.	No negative impact to cultural or natural resources. The *Mooli-Mooli* would not be impacted.
7. Use of Institutional Controls	Institutional controls identified in the TSD ROD would remain unchanged.	Institutional controls identified in the TSD ROD would remain unchanged.	Institutional controls identified in the TSD ROD would remain unchanged, but other ICs may be necessary in the final ROD to protect barrier.	Institutional controls identified in the TSD ROD would remain unchanged, but other ICs may be necessary in the final ROD to ensure no irrigation is applied.
8. Long-Term Monitoring Costs	No impact.	No impact	Cost is included above.	Cost is included above.

Figure 1. 100-NR-1 Operable Unit.

Figure 2. 116-N-1 Conceptual Subsurface Cross Section.



APPENDIX A

ASSUMPTION SUMMARY INFORMATION

Table A-1. Assumption Summary: Excavation to Groundwater.

Item	Assumption
Excavate and stockpile clean overburden, then return to excavation	Assumes 2:1 slope.
Excavate and stage for transport contaminated soil	Assumes entire footprint and additional 30% of soil beyond excavation footprint is contaminated.
Transport and disposal of contaminated soil in the Environmental Restoration Disposal Facility (ERDF)	Assumes 458,562 additional tons transported and disposed and construction of ERDF capacity.
Backfill from onsite borrow pit	Assumes borrow pit less than 6 km from waste site.
Project support	Includes Radiation Control Technician, Health and Safety, Field Oversight, Engineering and Environmental, Waste Management, and Sampling and Analytical costs for the 33-month duration.

Assumes traditional excavation methods currently used. Generalized conceptual excavation cross section shown below.

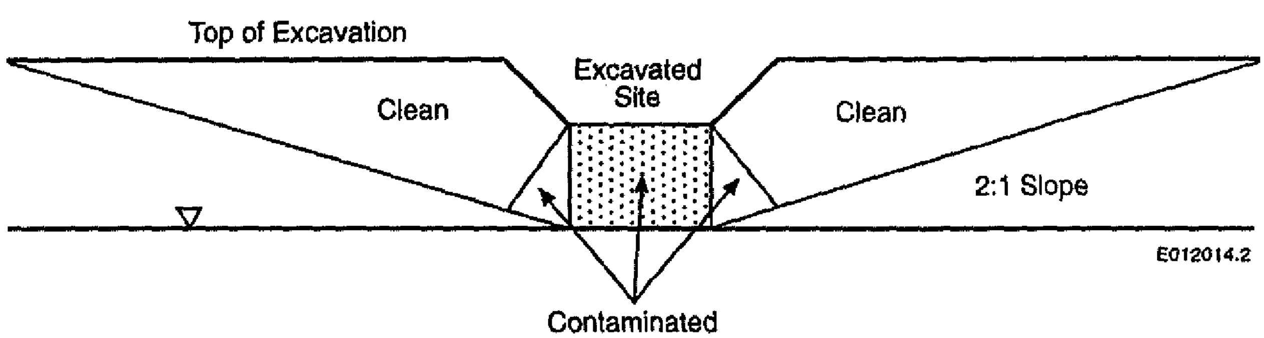


Table A-2. Assumption Summary: Soil Removal by Augering to Groundwater.

Item	*Assumption*
Augering	Assumes 2-m-diameter holes with 1-m-diameter holes in between. This equates to approximately 2,283 2-m holes, and 2,553 1-m holes over the entire excavation footprint.
Grouting	Grout displaces soil in the holes. Assumes a batch plant is set up on site.
Transport and disposal of contaminated soil in the Environmental Restoration Disposal Facility (ERDF)	Assumes 349,007 additional tons transported and disposed and construction of ERDF capacity.
Project support	Includes Radiation Control Technician, Health and Safety, Field Oversight, Engineering and Environmental, Waste Management, and Sampling and Analytical costs for the 62-month duration.

Four large bore (2-m) machines used in this estimate. Only 98% of the contaminated soil will be removed due to the circular nature of holes. Basic hole layout pattern shown below.

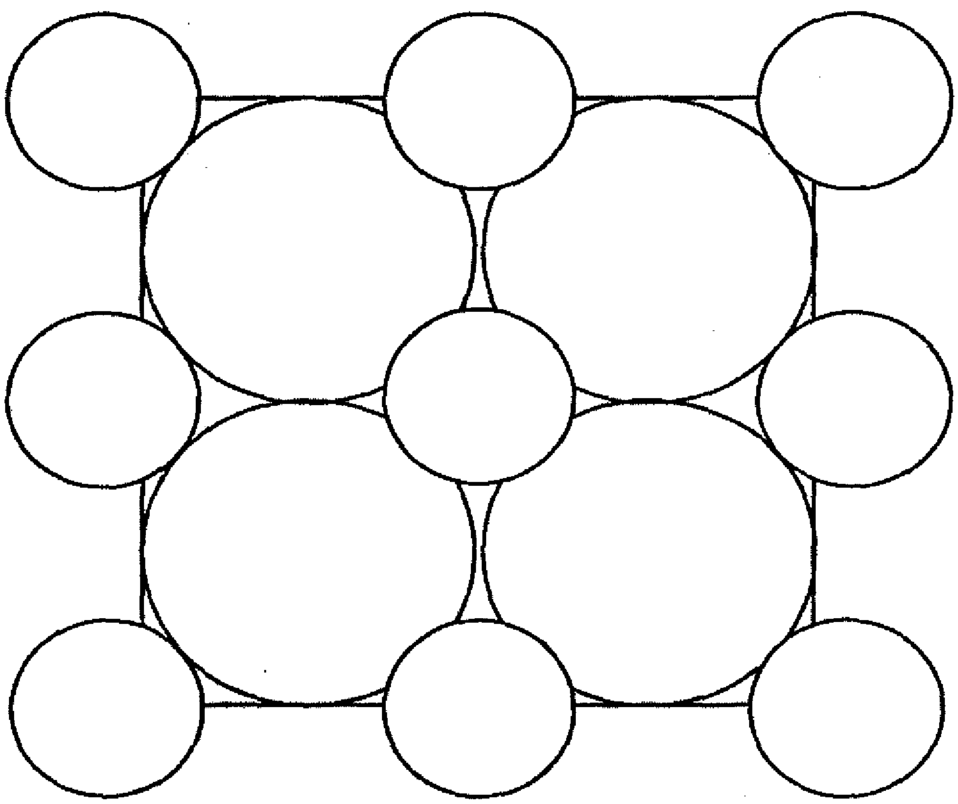


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Table A-3. Assumption Summary: Subsurface Barrier.

Item	Assumption
Excavate and stockpile clean overburden, then return to excavation	Assumes 1.5:1 slope, removal of additional 20-ft perimeter around entire waste site to reduce lateral infiltration.
Excavate, transport, and dispose of contaminated soil in the Environmental Restoration Disposal Facility (ERDF)	Assumes 6,392 additional tons of contaminated soil transported and disposed and construction of ERDF capacity.
Backfill lowest layer from onsite borrow pit	Assumes borrow pit less than 6 km from waste site.
Install 2-ft clay liner excavation	*RS Means Environmental Cost Data.*
Install 80-mil high-density polyethylene geotextile liner above clay layer	*RS Means Environmental Cost Data.*
Project support	Includes Radiation Control Technician, Health and Safety, Field Oversight, Engineering and Environmental, Waste Management, and Sampling and Analytical costs for the 13-month duration.

Generalized conceptual cross section shown below.